



# Nanomaterials and Technologies for Naval Applications

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Nanotechnology Partnership Forum  
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# Summary

- Wide range of defense applications for nanomaterials
- Established mechanisms for collaboration
  - SBIR / STTR (ONR, NAVSEA, others)
  - Mantech
  - Other ONR-sponsored mechanisms
  - NSRP
  - Relevant conferences



# Connecting

## ➤ SBIR / STTR

- <http://www.navysbir.com/>
- <http://www.acq.osd.mil/osbp/sbir/>
- <https://www.fbo.gov/>

## ➤ Navy Manufacturing Technology (Mantech)

### • Centers of Excellence

<http://www.onr.navy.mil/Science-Technology/Directorates/Transition/Manufacturing-ManTech.aspx>

- Benchmarking and Best Practices Center of Excellence (B2PCOE)
- Center for Naval Shipbuilding Technology (CNST)
- Composites Manufacturing Technology Centers (CMTC)
- Electro-Optics Center (EOC)
- Electronics Manufacturing Productivity Facility (EMPF)
- Energetics Manufacturing Technology Center (EMTC)
- Institute for Manufacturing and Sustainment Technologies (iMAST)
- Navy Joining Center (NJC)
- Navy Metalworking Center (NMC)
- <https://www.dodmantech.com/>

# Connecting

- ONR: <http://www.onr.navy.mil/>
  - Office of Innovation
  - Office of Research
  - Office of Transition
- National Shipbuilding Research Program  
<http://www.nsrp.org/>
- Opportunities at conferences
  - Naval S&T Partnership Conference
  - SBIR <http://www.acq.osd.mil/osbp/sbir/conferences/>
  - Defense Manufacturing Conference
  - Mantech Center of Excellence Conferences
    - SHIPTECH (Navy Metalworking Center)



# Connecting

## Naval S&T Partnership Conference

- Pitch-A-Principal: meet with an ONR subject matter expert about your idea. Submissions through Sept. 30.

<http://www.onr.navy.mil/Conference-Event-ONR/science-technology-partnership/pitch-principal.aspx>

- Industry can sign-up to give an Independent Research & Development brief to government:

<http://www.onr.navy.mil/Conference-Event-ONR/science-technology-partnership/Independent-Research-Development.aspx>

- CNR Challenge: submit a white paper at the conference to compete for \$1 million in research funds:

<http://www.onr.navy.mil/Conference-Event-ONR/science-technology-partnership/2010-CNR-Challenge.aspx>

# Nanomaterials for Defense

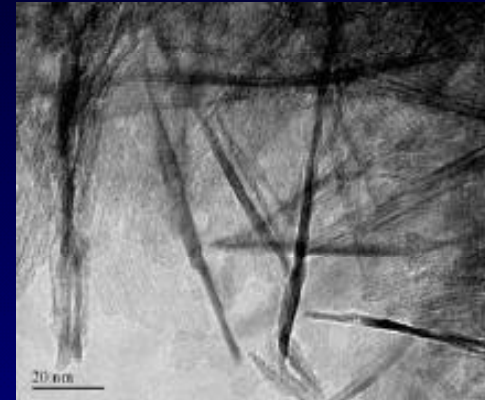
- Filtration and Biocides
- Composite material reinforcement
- Multifunctional coatings
- Energy and electromechanical systems
- Optical systems
- Nanoelectronics (nanocircuits, sensors)



# Filtration and Biocides

## ➤ NanoCeram® alumina filter and Seldon filters

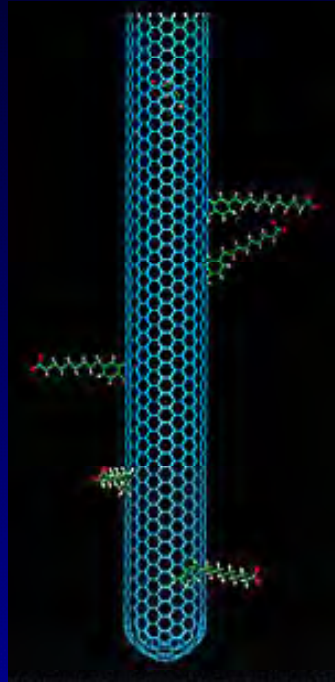
- Air Force sponsored
- Water purification
- Bacteria and viruses
- Arsenic
- High efficiency
- High throughput





# Composite Material Enhancement

Functionalized  
carbon nanotubes



Foster-Miller

MER Corp.

NanoLab

NanoRidge Materials

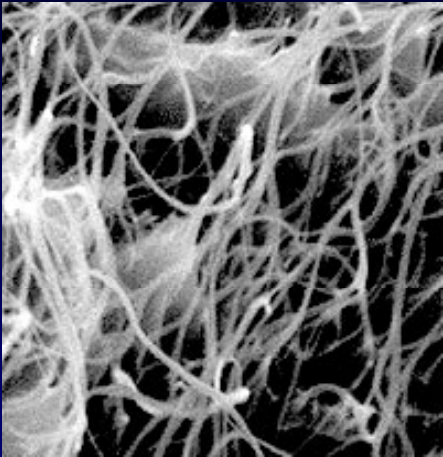
Systran Federal Corp.

Carbon Solutions

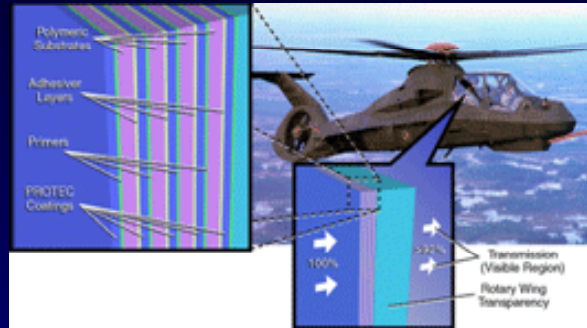
Triton Systems

- Increased stiffness
- Controlled permittivity for radomes
- Erosion and cavitation resistance for fan blades

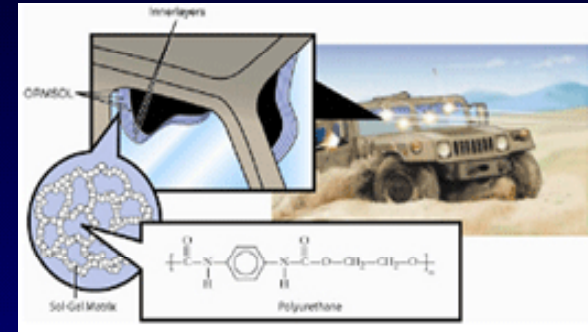
# Multifunctional materials, coatings



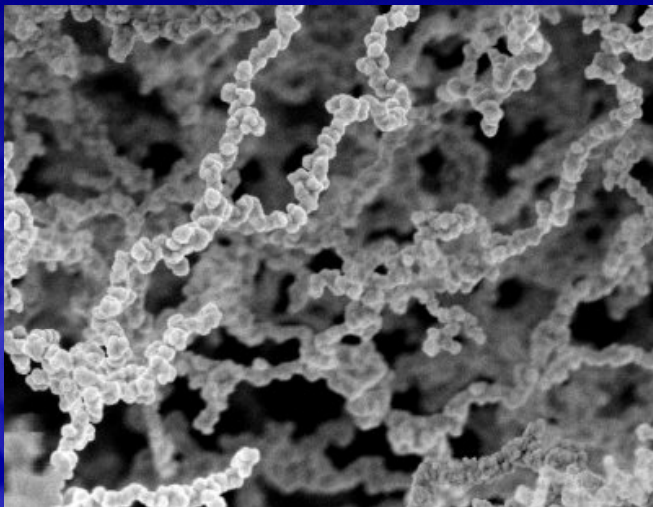
ONR: SWNT for conductive gap sealants in aircraft



Nanoparticles in glass coatings for anti-fogging, abrasion resistance



Nanocomposite polymer in ballistic windows



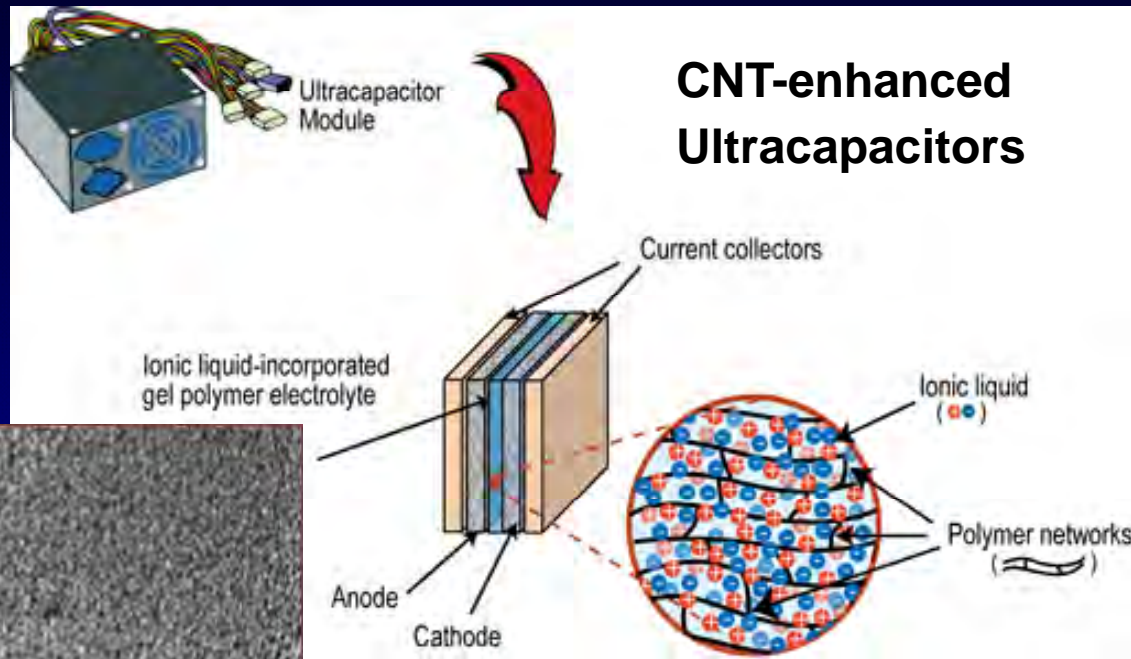
AFRL: Nickel nanostrands for conductive resins, paints, adhesives; EMI shielding

NAVSEA: Super hydrophobic surfaces, damage sensing and self-repairing

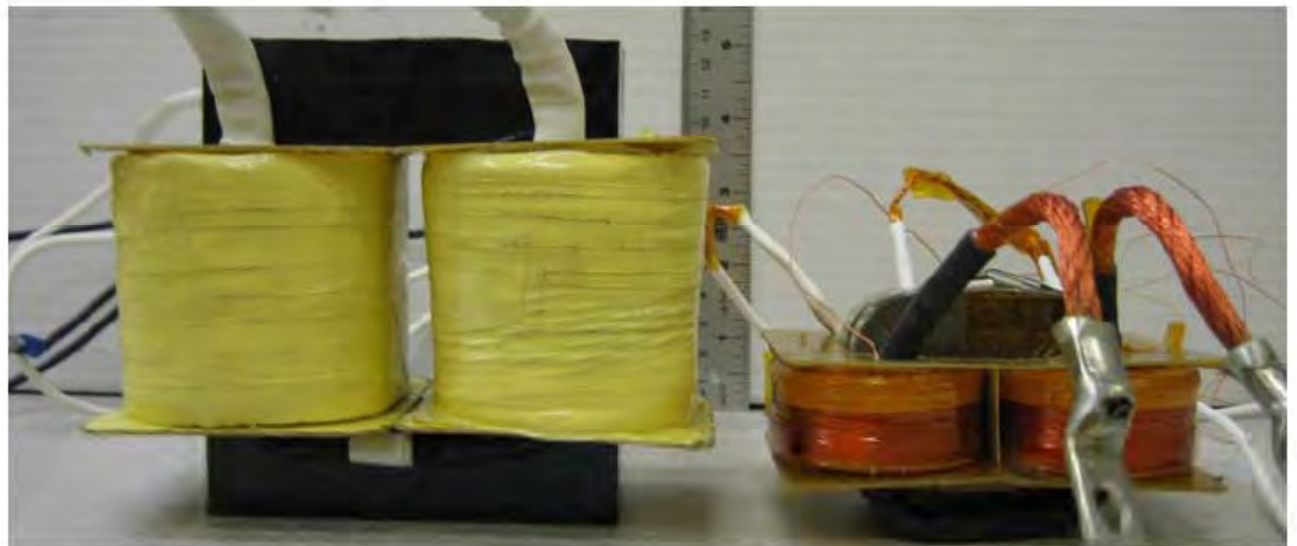




# Energy and Electromechanical



**ONR: Nanocrystalline  
cores in power  
converters**

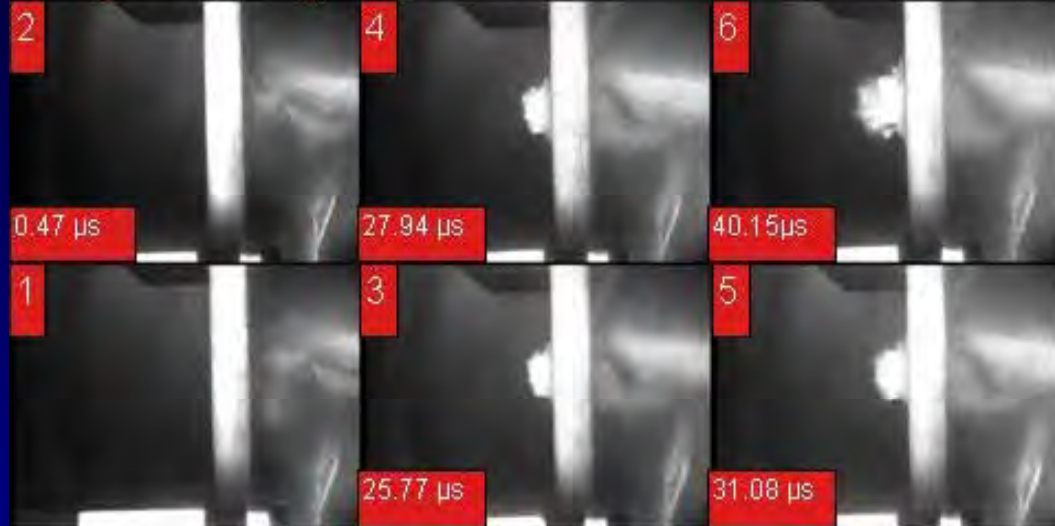


**Fig. 5-15 30 kW ferrite core (left) and FT-3M nanocrystalline core (right) transformer prototypes**

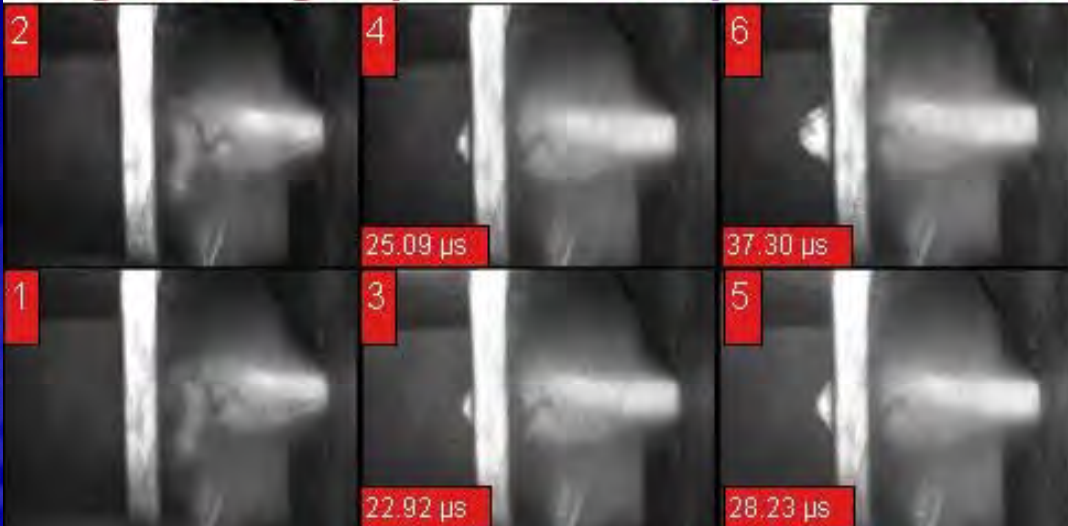
# Body Armor

Nanoparticle and nanotube reinforcement

Images During Impact Neat Sandwich



Images During Impact Nanophased Sandwich

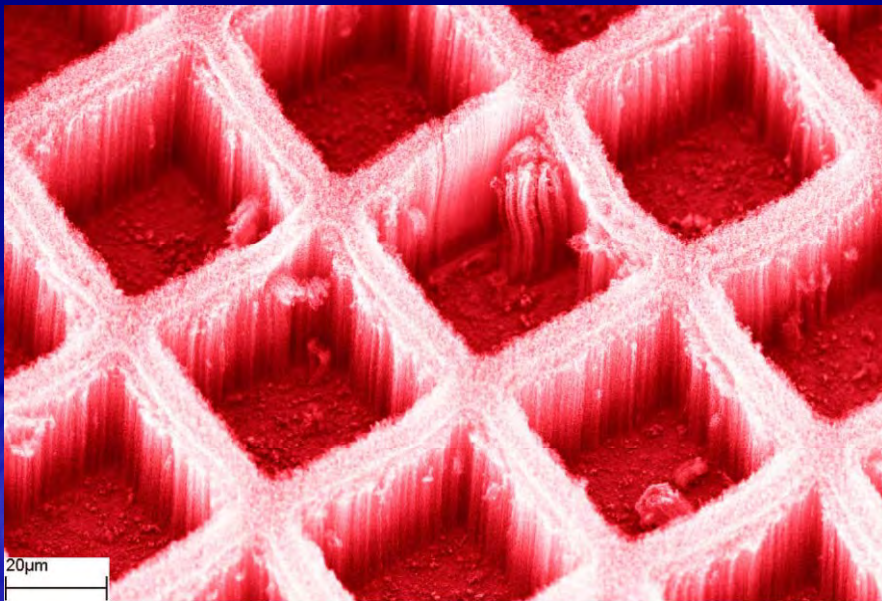




# Photovoltaics



**Flexible solar cells, printing technology, increased efficiencies with nanoparticles**



**Nanotubes on silicon  
increase surface area**



# Nanoelectronics

OSD10-T004

Nanomanufactured catalytic arrays on  
patterned addressable substrates for  
advanced electronic device applications

<http://www.dodsbir.net/Topics/Default.asp>

Deadline: 15 Sept 2010

Goal: uniform growth of high quality multiwalled CNTs  
perpendicular to substrate  
low base contact resistance



# Summary

- Wide range of defense applications for nanomaterials
- No “Nano-Central”
- Traditional mechanisms for collaboration
  - SBIR / STTR program managers: Get to know them
  - Mantech
  - Other ONR-sponsored mechanisms
  - Conferences of interest
  - NSRP: Connect with shipbuilders

# References

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- <http://www.seldontechnologies.com/products/>
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- <http://www.nanosolar.com/>
- <http://www.honda.com/solar-cell/>



# Questions?

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**<http://www.navsea.navy.mil/nswc/carderoack/>**